STATE OF VERMONT
PUBLIC SERVICE BOARD

Docket No. 7336

Petition of Central Vermont Public Service	)
Corporation for Approval of an Alternative	)
Regulation Plan Pursuant to 30 V.S.A. § 218d	)

REVENUE ADJUSTMENT MECHANISMS FOR CENTRAL VERMONT PUBLIC SERVICE CORPORATION

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REVENUE ADJUSTMENT MECHANISMS FOR CVPS

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REVENUE ADJUSTMENT MECHANISMS FOR CVPS

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1. Introduction and Summary

1.1 Introduction

Central Vermont Public Service Company ("CVPS" or "the Company") has in Docket No. 7336 proposed an alternative rate plan ("ARP") that, like others approved in Vermont, features caps on revenue requirements. A "Unicap" limits growth in the company's total revenue requirement. A "Subcap" limits growth in the company's customer care and administrative and general expenses.

On May 30, Vermont Department of Public Service ("DPS") witness Ron Behrns filed testimony that proposed an alternative ARP that features a cap on "non-power cost". In the words of Mr. Behrns, this cap

> would be formulaically determined by using a lagging consumer price index, prospectively adjusted for the rate year (1) targeted productivity changes and (2) any unusual base rate changes occasioned by known and measurable and used and useful net plant and other rate base additions.

The base level of non power cost would escalate by about 2.03% annually in 2009 and 2010. This growth trend is established as half of the recent inflation in the consumer price index for all urban consumers (CPI^U). Allowances for an uptick in capital spending would increase the escalation in the cap proposed by Behrns by about fifty basis points to an average of 2.56% in these two years.

Revenue adjustment mechanisms must be carefully designed if they are to satisfy the just and reasonable standard under Vermont statute. The need for careful work is especially great in this proceeding since, under the CVPS proposal and that of Mr. Behrns, there is an unusual role for cost filings during the ARP period that is also found in the Green Mountain Power ("GMP") ARP. CVPS would continue to make annual cost filings and the revenue requirement would be set at the *lesser* of the cap generated by the revenue escalation formula and the Company's actual cost.

Statistical cost research is useful in developing just and reasonable revenue adjustment mechanisms. This document reports on research undertaken by Pacific Economics Group to develop a non-power cost cap for CVPS once issues (discussed in our direct testimony) concerning the base for the cap are resolved. Results are also generated that shed light on the reasonableness of the Subcap escalator proposed by CVPS.

1.2 Principles of Revenue Adjustment Mechanism Design

Indexing mechanisms are commonly used today in utility regulation around the world. Index logic yields results that are useful in designing revenue adjustment mechanisms. The key result is that growth in cost equals growth in input prices less growth in productivity plus growth in output. When power distributor services (*e.g.* local power delivery, customer care, and administrative and general services) are the main activities subject to regulation, output is conveniently measured by the number of customers served.

These results support the following general revenue escalation formula:

$$\textit{growth Revenue} = \textit{Inflation} - X + \textit{growth Customers}.$$

When a macroeconomic inflation measure such as the consumers price index for all cities ("CPI^U") is used in such a formula, the X factor must reflect a productivity target and any difference between the trend in the CPI^U and the input price trend of the utilities. When the sum of these X factor terms is similar to customer growth, the revenue escalation formula simplifies to

$$\textit{Growth Revenue} = \textit{growth } CPI^U.$$

A mechanism to adjust growth in the revenue requirement for input price, productivity, and customer growth can be stated equivalently as a mechanism to adjust revenue per customer for inflation and productivity growth. A revenue per customer index of general form

$$\textit{growth Revenue/Customer} = \textit{Inflation} - X$$

has been approved for use in Vermont to regulate services of Vermont Gas System ("VGS").

1.3 Empirical Findings

We have calculated input price and productivity indexes for the power distributor services of CVPS and samples of northeastern and U.S. utilities. The 0.74% average annual growth in the productivity of Northeast power distributors is well below the 2.03% productivity target proposed by Behrns. The 0.91% growth in the productivity of CVPS exceeds the average for the Northeast. Growth in power distribution input prices exceeds the growth in the CPI^U. The 0.99% annual customer growth trend of CVPS exceeds the 0.76% trend for the Northeast and is only modestly below the trend for the full U.S. sample.

A revenue per customer index for non power cost that reflects the customer growth trend of CVPS and the input price and productivity trends of Northeast power distributors would have averaged about 3.62% annual growth from 2001-2006. Provided that the CPI^U is used as the inflation measure in a revenue escalation formula of general form, we recommend a revenue cap index for non power cost of form

$$\textit{Growth Revenue/ Customer}^{CVPS} = \textit{growth } CPI^U - 0.18.$$

The escalation formula is similar to that which the Board approved for VGS.

We also computed an input price index for the cost categories covered by the Subcap proposed by CVPS. We found that it grew at a rate similar to that of the national CPI for services. Given the 0.99% customer growth trend of CVPS, the productivity target implicit in the Company's proposal is similar to its historical productivity trend and a little above the productivity trend for the Northeast. Subcap costs are therefore a good candidate for the inflation-only approach to revenue cap escalation that CVPS proposes.

2. Design Principles for Revenue Adjustment Mechanisms

Input price and productivity research has been used for more than twenty years to design the rate and revenue adjustment mechanisms of ARPs. Index logic provides the rationale for this approach. To understand the logic of using indexing to design revenue adjustment mechanisms, it is necessary first to have a high level understanding of input price and productivity indexes. We provide this in Section 2.1. There follows in Section 2.2 an extensive non-technical explanation of the use of indexing in ARP design. Details of our index research for CVPS can be found in Section 3.

2.1 Basic Concepts

2.1.1 Revenue Adjustment Mechanisms

Revenue adjustment mechanisms are used to escalate the revenue requirement of a utility. Escalation is sometimes achieved using predetermined formulas that make adjustments automatically for changes in business conditions that drive cost but cannot be controlled. Price, productivity, and output indexes are commonly used for this purpose. The escalation formulas usually pertain to one or more subsets of a utility's total cost of service. For example, they sometimes pertain to most or all costs of base rate inputs (*e.g.* labor, materials, services, and utility plant but not energy). Another common application is to O&M expenses.

Revenue adjustment mechanisms may, alternatively, be based on multi-year cost projections. The resulting revenue caps may then take the form of "stairsteps". A "hybrid" approach is also used in some jurisdictions under which budgets for O&M expenses are escalated using indexes whereas budgets for capital cost are escalated using forecasts.

2.1.2 Price Indexes

Price indexes are used to make price comparisons. Indexes used in revenue adjustment mechanism design measure price *trends*. Indexes can summarize the trends in the prices of multiple products by taking weighted averages of these trends. An index of trends in the prices a utility pays for its inputs should use *cost share* weights because these weights capture the impact of input price growth on cost.

2.1.3 Output Indexes

The output (quantity) index of a firm or industry summarizes trends in one or more dimensions of the amount of work it performs. Each dimension of workload that is considered is measured by a subindex. Output indexes can summarize the trends in several subindexes by taking a weighted average of them.

In designing an output index, the choice of subindexes and weights depends on the manner in which it is to be used. In the design of a revenue adjustment mechanism, the objective is to measure the impact of output growth on utility *cost.* In that event, the subindexes should measure the dimensions of workload that "drive" cost. The weights should reflect the relative importance of the cost elasticities that correspond to these drivers.[1] The elasticity of cost with respect to an output quantity is the percentage change in cost that will result from a 1% change in the quantity. Research on the cost of power distributor services suggests that the number of customers served is the dominant cost driver.

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[1] Output indexes used in the design of *price* cap indexes typically measure the impact of output growth on *revenue.* In that event, the subindexes should measure trends in *billing determinants* (*e.g.* delivery volumes, maximum demand, and the number of customers served) and the weights should be the share of each determinant in revenue. The output growth of an electric utility can be quite different (and, for most utilities, is higher) using a revenue weighted index because greater weight is placed on delivery volumes, which are often faster growing.

2.1.4 Productivity Indexes

A productivity index is the ratio of an output quantity index to an input quantity index.

$$Productivity = \frac{Output\ Quantities}{Input\ Quantities}.$$

It is used to measure the efficiency with which firms convert inputs to outputs. The indexes we developed for this study measure productivity trends.

The growth trend of such productivity indexes is the difference between the trends in the output and input quantity indexes.

$$trend\ Productivity = trend\ Output\ Quantities - trend\ Input\ Quantities. \qquad [1]$$

Productivity thus grows when the output quantity index rises more rapidly (or falls less rapidly) than the input quantity index. Productivity growth is characteristically volatile due to fluctuations in output and the uneven timing of certain expenditures. The volatility is often greater for individual companies than for an aggregation of companies such as a regional industry.

The input quantity index of an industry summarizes trends in the amounts of production inputs used. Growth in the usage of each input category considered separately is measured by a subindex. Capital, labor, and miscellaneous materials and services ("M&S") are the major classes of base rate inputs used by electric utilities. A total factor productivity ("TFP") index measures productivity in the use of *all* inputs. An index that measures productivity in a subset of the full array of inputs is called a *partial* factor productivity ("PFP") index.

Theoretical and empirical research has found the sources of productivity growth to be diverse. One important source is technological change. New technologies permit an industry to produce given output quantities with fewer inputs.

Economies of scale are a second source of productivity growth. These economies are available in the longer run when cost characteristically grows less rapidly than output. In that event, output growth can slow unit cost growth and raise productivity. A company's potential for scale economy realization depends on its current operating scale and on the pace of its output growth. Incremental scale economies will typically be greater the more rapid is output growth.

A third important source of productivity growth is change in X inefficiency. X inefficiency is the degree to which individual companies operate at the maximum efficiency that technology allows. Usage of capital, labor, and materials and services all matter. Productivity will grow (decline) to the extent that X inefficiency diminishes (increases). The potential of a company for productivity growth from this source is greater the greater is its current level of operating inefficiency. Evidence on operating efficiency can be produced using statistical benchmarking.

An important source of productivity growth in the shorter run is the degree of capacity utilization. Producers in most industries find it uneconomical to adjust production capacity to short-run demand fluctuations. The capacity utilization rates of industries therefore fluctuate. Productivity grows (declines) when capacity utilization rises (falls) because output is apt to change much more rapidly than capacity.

Another short-run determinant of productivity growth is the intertemporal pattern of expenditures that must be made periodically but need not be made every year. Expenditures of this kind include those for replacement investment and maintenance. A surge in such expenditures can slow productivity growth and even result in a productivity decline. Uneven spending is one of the reasons why the productivity growth of individual utilities is often more volatile than the productivity growth of the corresponding industry.

A sixth important source of productivity growth is changes in the miscellaneous other external business conditions that affect cost. A good example for a combined gas and electric utility is the number of gas customers served. Economies of scope are possible from the joint provision of gas and electric service. Growth in the number of electric customers served can, by reducing the cost of gas distribution, boost productivity growth.

2.2 Role of Index Research in Revenue Adjustment Mechanism Design

2.2.1 Basic Escalation Formula

The mechanism used to escalate revenues (or rates) is one of the most important components of an ARP. Such mechanisms are substituted for rate cases as a means to adjust utility rates for trends in input prices, demand, and other external business conditions affecting utility earnings. This makes it possible to extend the period between rate cases without relaxing the just and reasonable standard for regulation. Performance incentives can be strengthened and regulatory cost trimmed. Operating risk can be reduced without weakening utility performance incentives.

An approach to the design of rate and revenue escalation mechanisms has been developed in North America using indexes that is grounded in theoretical and empirical research. The analysis begins by considering that the growth trend in the revenue requirement of a utility industry operating under cost of service regulation equals the growth trend of its corresponding cost.

$$\textit{trend Revenue} = \textit{trend Cost}. \qquad [2]$$

We could, in principle, use equation [2] to regulate growth in the revenue requirement of a utility by having it equal the trend in the corresponding cost of a peer group. However, this would be reasonable if those utilities faced similar trends in the external business conditions that drive cost.

Consider, now, that the trend in an industry's *total* cost is the sum of the trends in appropriately specified industry input price and quantity indexes. Thus

$$\textit{trend Revenue} = \textit{trend Input Prices} + \textit{trend Input Quantities}. \qquad [3]$$

Suppose, next, that we have in hand an index that measures the effect of output growth on cost. Then

$$\begin{aligned}\textit{trend Revenue} &= \textit{trend Input Prices} - (\textit{trend Output - trend Input Quantities}) \\ &\qquad + \textit{trend Output} \\ &= \textit{trend Input Prices} - \textit{trend Productivity} + \textit{trend Output} \qquad [4]\end{aligned}$$

The trend in the revenue requirement thus decomposes into trends in appropriately specified input price, productivity, and output indexes. It is then reasonable to use a revenue adjustment mechanism that reflects the input price and output growth *of the utility to which it applies* and uses peer group data only to establish the productivity trend.

Suppose, now, that the number of customers served is the dominant output-related driver of cost. Formula [4] can then be simplified to

$$\textit{trend Revenue} = \textit{trend Input Prices} - (\textit{trend Customers} - \textit{trend Input Quantities}) + \textit{trend Customers}. \qquad [5]$$

Revenue requirement growth is the sum of input price growth and customer growth less the trend of a special productivity index where the *number of customers* is the output measure. In other words, the revenue adjustment mechanism must reflect the net effect of customer growth on cost. The net effect on cost depends on the productivity with which the utility makes customer additions.

Rearranging the terms of [5] we obtain

$$\textit{trend Revenue} - \textit{trend Customers} = \textit{trend Input Prices} - (\textit{trend Customers} - \textit{trend Input Quantities})$$

An equivalent result can be obtained by using the formula

$$\textit{trend Revenue/Customer} = \textit{trend Input Prices} - (\textit{trend Customers} - \textit{trend Input Quantities}) \qquad [6]$$

and then using a utility's latest customer numbers to establish the new revenue requirement. The trend in revenue per customer thus depends on input price inflation and the efficiency with which the firm makes customer additions.

Special, more simplified formulas are sometimes used in revenue adjustment mechanism design. Most notably, if customer growth is set equal to the productivity target, equation [5] simplifies to

$$\textit{trend Revenue} = \textit{trend Input Prices}.$$

2.2.2 Short Run vs. Long Run

Another important issue in the design of a revenue adjustment mechanism is whether it should track short run or long run cost developments. An index designed to track short run growth will also track the long run growth trend if it is used over many years. An alternative approach is to design the index to track *only* long run trends. Different approaches can, in principle, be taken for the input price, productivity, and customer components of the escalation formula.

One issue to consider is the effect on risk. A revenue adjustment mechanism that tracks short-term fluctuations in cost drivers reduces utility operating risk. This can permit an extension of the period between rate reviews that strengthens performance incentives.

Consider, next, the costs of designing revenue adjustment mechanisms and using them to make rate adjustments. This cost depends in part on data availability. Data on input price and customer trends are available more quickly than the cost data that are needed, additionally, to measure productivity trends. Final data needed to compute the productivity growth of US power distributors in 2007, for instance, will not be available until the fall of 2008. The longer lag in the availability of cost and quantity data is due chiefly to the fact that these data typically come from *annual* reports whereas price indices are often calculated and reported on a *monthly or quarterly* basis.

Implementation cost also depends on the feasibility of calculating current long run trends accurately. Methods have been developed to measure the recent long run trend in the productivity of the industry. The recent long run trend in an industry's productivity is, moreover, often if not always a good proxy for the *prospective* trend over the next several years.[2]

The use of historical data on industry input price trends to calculate the prospective future trend is more problematic. Industry input price indexes are often volatile. The calculation of an average annual growth rate thus depends greatly on the choice of the sample period. It can be difficult to reach consensus on what sample period would yield a long term input price trend. One reason is that research on the short run drivers of fluctuations in utility input prices is not well advanced. Absent a scientific basis for sample period selection, the choice of a sample period can engender controversy

[2] Reliance on the long run trend can be problematic, however, when applied to utilities that contemplate major capital additions.

and raise the risk of ARPs for utilities. Higher regulatory risk can raise the cost of funds and reduce thereby the net benefits of ARPs.

Historical trends in input prices are, furthermore, sometimes poor predictors of the trends that will prevail in the near future. Suppose, by way of example, that there has been rapid input price inflation in the last ten years but that the expectation is for more normal inflation in the next five years. In this situation, regulators would presumably be loath to fix revenue growth at a rate that reflects the historical trend.

Examination of the input prices of an electric utility like CVPS suggests that they are somewhat volatile. Since power delivery is capital intensive, the summary input price index is quite sensitive to fluctuations in the price of capital. The trend in a properly constructed capital price index depends on trends in plant construction costs and the rate of return on capital. Both of these components are more volatile than the general run of prices in our economy. The rate of return on capital depends on the balance between the supply of and the demand for funds, and reflects expectations regarding future price inflation.[3] From the late 1970s through the mid 1980s, for instance, yields on long-term bonds were far above historical norms due in large measure to inflation worries spurred by oil price shocks. They fell gradually for many years thereafter as concerns about inflation receded. More recently, long bond yields have been held down by efforts of the governments of China and other large exporting countries to control exchange rates. Speculation on when and how much these policies will change is a staple of the financial press.

A sensible weighing of these considerations leads us to conclude that different treatments of input price, productivity, and customer growth are in most cases warranted in revenue adjustment mechanism design. The escalation formula should track *short term* input price and customer growth. The X factor, meanwhile, should generally reflect the long run productivity trend of a peer group.

This general approach to revenue adjustment mechanism design has important advantages. Prompt adjustments for input price inflation and customer growth exploit the

[3] The rate of return on capital also reflects return on equity. Returns on equity have also been volatile and are not highly correlated with bond yields.

greater availability of the requisite data and can materially reduce utility operating risk without weakening performance incentives. Having X reflect the long run industry productivity trend, meanwhile, sidesteps the need for more timely cost data and avoids the chore of annual productivity calculations.

2.2.3 Inflation Measures

Resolved that the inflation measure of a revenue adjustment mechanism should track recent price growth, other important issues of its design must still be addressed. One is whether it should be *expressly* designed to track industry input price inflation as per equation [5]. There are several precedents for the use of such industry-specific inflation measures in rate adjustment indexes. Such a measure was used in one of the world's first large scale ARPs, which applied to US railroads. Staff of California Public Utilities Commission ("CPUC") developed an approach to measuring industry input price inflation that was used in several plans. Ontario Energy Board staff chose an industry specific inflation measure for the first price cap plan for Ontario power distributors.

Notwithstanding such precedents, the majority of ARP indexing plans approved worldwide do not feature industry-specific inflation measures. They instead feature measures of economy-wide *output* price inflation. CPIs are computed on a monthly basis by the Bureau of Labor Statistics ("BLS") and measure inflation in the prices of consumer goods and services. Gross domestic product price indexes are computed on a quarterly basis by Bureau of Economic Analysis ("BEA") of the U.S. Department of Commerce to measure inflation in the prices of all of the economy's final goods and services. Final goods and services consist chiefly of consumer products but also include government services and capital equipment.

Macroeconomic inflation measures have noteworthy advantages over industry-specific measures in rate adjustment indexes. One is that they are available from respected and impartial sources such as the Federal government. Customers are more familiar with them, and this facilitates acceptance of rate indexing generally. There is no need to go through the chore of annual index calculations. Controversies over the design of an industry-specific price index are sidestepped.

On the other hand, the use of a macroeconomic measure involves its own PCI design challenges. When a macroeconomic inflation measure is used, the PCI must be calibrated in a special way if it is to track the industry unit cost trend. Suppose, for example, that the inflation measure is a CPI. In that event we can restate relation [5] as

$$\textit{growth Revenue} = \textit{growth CPI} - [\textit{trend Productivity} + (\textit{trend CPI} - \textit{trend Input Prices})] \quad [7]$$

The term in parentheses may be called an "inflation differential". It follows that a revenue adjustment mechanism can still conform to index logic when CPI is the inflation measure provided that the X factor is calibrated to reflect any tendency of the CPI to grow more rapidly or more slowly than an industry specific price index.

2.2.4 Relevant Region

The index theory discussed in Part 2.2.1 requires a definition of the industry. A variety of regional definitions may be reasonably considered. In choosing among these we are guided by the following principles. First, the region should be broad enough that the productivity trend of its industry is substantially insensitive to the actions of subject utilities. This may be called the externality criterion. It is desirable, secondly, for the region to be broad enough that the productivity trend is not dominated by the actions of any two or three utilities. This may be called the size criterion.

A third criterion is that the region should be one in which external business conditions that influence input price and productivity growth are similar to those of utilities that may be subject to the indexing plan. This may be called the no windfalls criterion. Similarity in input prices is especially important in reducing expected windfalls. For this reason, PEG frequently uses regional rather than national data samples in research supporting rate and revenue adjustment mechanisms where this doesn't violate the size and externality criteria.

3. EMPIRICAL WORK FOR CVPS

This section presents an overview of our work to develop revenue adjustment mechanism for CVPS. The discussion is largely non-technical. Additional details of the work are provided in the Appendix.

3.1 Data

The primary source of the cost data used in the study was the Federal Energy Regulatory Commission (FERC) Form 1. Major investor-owned electric utilities in the United States are required by law to file this form annually. Cost and quantity data reported on Form 1 must conform to the FERC's Uniform System of Accounts. Details of these accounts can be found in Title 18 of the Code of Federal Regulations.

FERC Form 1 data are processed by the Energy Information Administration ("EIA") of the U.S. Department of Energy. Selected Form 1 data were for many years published by the EIA.[4] More recently, the data have been available electronically in raw form from the FERC and in more processed forms from commercial vendors. FERC Form 1 data used in this study for some years of the sample period were obtained from vendors. Data for other years were obtained directly from the Form 1s.

Data were eligible for inclusion in the sample from all major investor-owned utilities in the United States that filed the Form 1 in 2006 and that, together with any important predecessor companies, have reported the necessary data continuously since they achieved a "major" designation. To be included in the study the data were required, additionally, to be of good quality and plausible. Data from 80 companies met these additional standards and were used in our indexing work. The data for these companies are the best available for rigorous work on input price, productivity, and output trends which can support the development of a revenue adjustment cap mechanism for CVPS. The included companies are listed in Table 1.

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[4] This publication series had several titles over the years. A recent title is *Financial Statistics of Major U.S. Investor-Owned Electric Utilities.*

Other sources of data were also accessed in the research. These were used primarily to measure input price trends. The supplemental data sources were Whitman, Requardt & Associates; the BEA; and the BLS. The specific data drawn from these and the other sources mentioned are discussed further below.

3.2 Index Details

3.2.1 Scope

The indexes calculated in this study measured the input price, productivity, and customer trends of utilities as power distributors. The major tasks of a distributor include the local delivery of power and the reduction in its voltage from the level at which it is received from the transmission network.[5] Most power is delivered to end users at the voltage at which it is consumed. Distributors also typically provide various customer services such as account, sales, and information services.

The costs considered in this study comprised operation and maintenance ("O&M") expenses and the cost of capital. Distribution cost was defined to include sensible shares of a utility's administrative and general ("A&G") expenses and its cost of general plant ownership. In the case of CVPS, our allocation procedure assigned the bulk of general costs to distribution.

The decomposition of capital cost into a price and a quantity is required if we are to measure input price and quantity trends. Under this general approach, the cost of capital is the product of a capital quantity index and an index of the price of capital services. Such decompositions have a solid basis in economics and have been widely used in scholarly research. The study used an approach to measuring capital prices and quantities that is designed to mirror the way that capital cost is calculated under cost of service ("COS") regulation.

[5] The term "distribution" in the Uniform System of Accounts corresponds most closely to these services.

3.2.2 Index Construction

The growth rate of each productivity index calculated in this study is the difference between the growth rates of indexes of industry output and input quantity trends. The number of customers served was used to measure output growth. The growth of the input quantity index is a weighted average of the growth in quantity subindexes for labor, other O&M inputs used in distribution and customer services, power distribution plant, and general plant. The growth of each input price index is a weighted average of the growth in price subindexes for these same input groups. Cost shares are used as weights in both kinds of indexes.

3.2.3 The Sample

The sample period for the productivity research was 1996-2006. Data for 2007 have just become available and could not be processed in time for this filing. An extension of CVPS indexes to 2007 is complicated by the utility acquisitions that occurred in that year. We do not believe that the addition of 2007 data would materially change our results.

We computed input price and productivity indexes for CVPS, the Northeast, and the full U.S. sample. The Northeast region was defined as the six New England states and upstate New York. Thirteen of the sampled companies have service territories in this region.

3.3 Index Results

3.3.1 Input Prices

Table 2 and Figure 1 report key findings of our input price research. From 1996 to 2006 our index of inflation in the prices of CVPS power distributor base rate (*i.e.* non-power) inputs averaged 3.09% growth.[6] The index for the Northeast sample grew at a very

[6] All growth trends noted in this report were computed logarithmically.

similar pace while that for the US grew more slowly. The CPI^U, meanwhile, averaged 2.51% growth from 1996-2006. The price differential resulting from a comparison of the trends in CPI^U and the power distributor base rate input price index for the Northeast was therefore 2.51 - 3.07 = -0.56.

Table 3 details the growth in an index that PEG constructed of the prices of goods and services involved in the Subcap costs of CVPS. We find that this index averaged 3.08% annual growth from 1996 to 2006. The national CPI for services, meanwhile, averaged 3.19% growth during these years. The inflation differential was therefore 3.19 – 3.08 = 0.11.

3.3.2 Productivity

Table 4 reports key results of our productivity research for CVPS, the Northeast, and the full U.S. sample. Findings are presented for the 1996-2006 period for the productivity index and the component output and input quantity indexes. It can be seen that, over the full sample period, the annual growth rate of productivity averaged 0.74% for the full Northeast sample. Customer growth averaging 0.76% annually outpaced input quantity growth that was close to zero. The 0.91% productivity growth achieved by CVPS was a little above that for Northeast and a little below the 1.03% growth trend for the full national sample.

3.3.3 Customer Growth

Table 4 also details the customer growth of CVPS and the sampled northeast and U.S. power distributors. It can be seen that the customer growth of CVPS averaged 0.99% annually over the full sample period. This growth was a little above that for the full northeast sample and modestly below the 1.24% growth trend for the full US sample. Any revenue adjustment cap mechanism that (unlike that for VGS) ignores the full effect of customer growth on the cost of CVPS will, evidently, reduce revenue requirement escalation by about 100 basis points.

3.3.4 Revenue Requirement Indexes

Non-Power Cost

Our research provides the foundation for a revenue requirement mechanism for the non-power cost of CVPS.[7] The most accurate index would have the following form:

$$\begin{aligned}&\textit{growth Revenue}^{CVPS}\\&= \textit{growth Input Prices}^{Northeast} - \textit{trend Productivity}^{Northeast} + \textit{growth Customers}^{CVPS}.\end{aligned}$$

This can be expressed, equivalently, as

$$\begin{aligned}&\textit{growth Revenue}^{CVPS}/\textit{Customer}^{CVPS}\\&= \textit{growth Input Prices}^{Northeast} - \textit{trend Productivity}^{Northeast}.\end{aligned}$$

For the productivity target, we propose the 0.74% annual productivity growth rate of the Northeast.

If, alternatively, a macroeconomic index such as the CPI^U is used as the inflation measure, the formula becomes

$$\begin{aligned}&\textit{growth Revenue}^{CVPS}/\textit{Customer}^{CVPS}\\&\quad= \textit{growth } CPI^U\\&\qquad - [\textit{trend Productivity}^{Northeast} + (\textit{trend Input Prices}^{Northeast} - \textit{trend } CPI^U)].\end{aligned}$$

In these calculations, we again recommend a 0.74% productivity growth target. For the input price differential, we recommend the difference between the input price trends of the Northeast and the CPI^U from 1996-2006. The value of X is then 0.74 + (2.51-3.07) = 0.18. This escalation formula would have yielded 3.62% average annual revenue growth during the 2001-2006 period and 4.01% growth over the more recent 2003-2006 period. This is a considerably more rapid pace of escalation than the 2.03% growth in the revenue adjustment mechanism that Behrns proposes.

[7] Additional acceleration may be added to fund the envisioned capital spending uptick.

Subcap Escalator

CVPS witness Deehan proposed that subcap costs be escalated annually by the growth in the national CPI for services. This is consistent with the principles we have enunciated concerning the design of revenue adjustment mechanisms. Customer care and A&G costs are the most labor intensive parts of a customer's business. Labor prices tend to rise more rapidly than the CPI. The CPI will thus tend to undercompensate CVPS for growth in the prices of subcap inputs. Over the 1996-2006 sample period we noted above that the prices of subcap inputs averaged 3.08% growth, while the CPI for services averaged 3.19% growth. The inflation differential resulting between the trends in CPI for services and Subcap input prices was thus 3.19 – 3.08 = 0.11. Given CVPS customer growth of about 1%, using the CPI for Services to escalate the Subcap thus implies a productivity target of 1 – 0.11 = 0.89. This is a little above the calculated productivity trend of the Northeast. The subcap costs are thus clearly a candidate for an "inflation only" revenue adjustment mechanism.

APPENDIX

This appendix contains additional details of our price and productivity research for CVPS. Section A.1 addresses our calculation of distribution cost. Sections A.2 and A.3 address the input price and input quantity indexes, respectively. The relevant region for the indexing work is discussed in Section A.4.

A.1 Distribution Cost

A.1.1 Total Cost

The total cost of power distribution was the sum of O&M expenses and capital costs for the distributor services considered. The services considered were local delivery, customer account, sales, and customer service and information. The procurement of power was not considered. Assigned O&M expenses consisted of all reported direct O&M expenses for distributor services plus a sensible share of the company's total A&G expenses. Assigned capital cost consisted of the cost of distribution plant and a sensible share of the cost of general plant.

A&G expenses are O&M expenses that are not readily assigned *directly* to particular operating functions under the Uniform System of Accounts. They include expenses incurred for pensions and other benefits, injuries and damages; property insurance, regulatory proceedings, stockholder relations, and general advertising of the utility; the salaries and wages of A&G employees, and the expenses for office supplies, rental services, outside services, and maintenance work that are needed for general administration.

General plant is plant that is not directly assigned to particular operating functions in the Uniform System of Accounts. Certain structures and improvements (*e.g.* office buildings), communications equipment, office furniture and equipment, and transportation equipment account for the bulk of general plant value. Other general plant categories in the Uniform System of Accounts include tools, shop, and garage equipment, laboratory equipment, miscellaneous power operated equipment, land and land rights, and stores equipment.

A.1.2 Capital Cost

The capital cost specification is extremely important in the design of a revenue adjustment mechanism. Capital prices are somewhat volatile, and capital typically accounts for half or more of the cost of power distribution. This combination of circumstances has made the calculation of the input price differential a controversial issue in a number of ARP proceedings.

Any approach to capital costing that is used in the design of a revenue adjustment mechanism must permit the decomposition of capital cost into a price and quantity index so that input price and productivity trends can be separately measured. Stated formally, the cost of a given class of utility plant j in a given year t ($CK_{j,t}$) must be the product of a capital service price index ($WKS_{j,t}$) and an index of the capital quantity ($XK_{j,t}$) .

$$CK_{j,t} = WKS_{j,t} \cdot XK_{j,t} \qquad [A1]$$

The concept of a price for the ownership of utility plant is not widely understood. This is due in part to the fact that such prices involve combinations of the prices of inputs that are discussed in the financial press. It is helpful to think of them as the prices that owners of capital services might charge in competitive rental markets. Stakeholders encounter such capital service prices any time they rent an automobile or a hotel room. Prices in competitive rental markets reflect, in the long run, the cost of capital ownership. The cost of owning an asset includes the cost of depreciation and the opportunity cost of contributing funds to the venture when there is a return to be had from the ownership of other assets.

An approach to capital costing has been used in the study that is designed to mitigate controversy by mirroring the approach typically taken under COS regulation. The hallmarks of COS capital cost accounting are straight line depreciation and book (historic) valuation of plant. Here is the mathematical derivation of our COS formulas. For each year, t, of the sample period let

ck_t = Total non-tax cost of capital

$ck_t^{Opportunity}$ = Opportunity cost of capital

$ck_t^{Depreciation}$ = Depreciation cost of capital

VK_{t-s}^{add} = Gross value of plant installed in year t-s

WKA_{t-s} = Unit cost of plant installed in year t-s (the "price" of capital assets)

a_{t-s} = Quantity of plant additions in year $t-s = VK_{t-s}^{add} / WKA_{t-s}$

xk_t = Total quantity of plant available for use and that results in year t costs

xk_t^{t-s} = Quantity of plant available for use in year t that remains from plant additions in year t-s

VK_t = Total value of plant at the end of last year

N = Service life of utility plant

r_t = Rate of return (cost of funds)

WKS_t = Price of capital service

A few assumptions that are made for convenience in the derivation to follow:

(1) All kinds of plant have the same service life N.

(2) Full depreciation and opportunity cost are incurred in year t on the amount of plant remaining at the end of year t-1, as well as on any plant added in year t

(3) The revenue adjustment mechanism is not designed to recover changes in taxes. Straightforward adjustments to the formulas are possible if more realistic alternatives to these assumptions are needed.

Consider, now, that the non-tax cost of capital under COS regulation is the sum of depreciation and the opportunity cost paid out to bond and equity holders.

$$ck_t = ck_t^{opportunity} + ck_t^{depreciation}$$

Assuming straight line depreciation and book valuation of utility plant

$$ck_t = \sum_{s=0}^{N-1} \left(WKA_{t-s} \cdot xk_t^{t-s}\right) \cdot r_t + \sum_{s=0}^{N-1} WKA_{t-s} (1/N) \cdot a_{t-s} \qquad [A2]$$

$$= xk_t \cdot \sum_{s=0}^{N-1} \left(\frac{xk_t^{t-s}}{xk_t} \cdot WKA_{t-s} \right) \cdot r_t + xk_t \cdot \sum_{s=0}^{N-1} WKA_{t-s} \cdot \frac{(1/N) \cdot a_{t-s}}{xk_{t-1}}.$$

where, as per assumption 2 above,

$$xk_t = \sum_{s=0}^{N-1} xk_t^{t-s}. \qquad [A3]$$

Under straight line depreciation we posit that in the interval $[(t-(N-1)),(t-1)]$,

$$xk_t^{t-s} = \frac{N-s}{N} \cdot a_{t-s}. \qquad [A4]$$

Combining [A3] and [A4] we obtain a capital quantity index that is a perpetual inventory equation.

$$xk_t = \sum_{s=0}^{N-1} \frac{N-s}{N} \cdot a_{t-s}. \qquad [A5]$$

The size of the addition in year t-s of the interval (t-1, t-N) can then be expressed as

$$a_{t-s} = \frac{N}{N-s} \cdot xk_t^{t-s}. \qquad [A6]$$

Equations [A2] and [A6] together imply that,

$$ck_t = xk_t \cdot \sum_{s=0}^{N-1} \left(\frac{xk_{t-1}^{t-s}}{xk_t} \cdot WKA_{t-s} \right) \cdot r_t + xk_t \cdot \sum_{s=0}^{N-1} \frac{xk_t^{t-s}}{xk_{t-1}} \cdot WKA_{t-s} \cdot \frac{1}{N-s} \qquad [A7]$$

$$= xk_t \cdot WKS_t.$$

Here,

$$WKS_t = \sum_{s=0}^{N-1} \frac{xk_{t-1}^{t-s}}{xk_t} \cdot WKA_{t-s} \cdot r_t + \sum_{s=0}^{N-1} \frac{xk_t^{t-s}}{xk_t} \cdot WKA_{t-s} \cdot \frac{1}{N-s}. \qquad [A8]$$

Relation [A7] reveals that the cost of capital under COS regulation can be decomposed into a capital price index and a capital quantity index. The capital service price in a given year reflects a weighted average of the capital asset prices in the N most recent years (including the current year). The weight for each year t-s is the estimated share, in the total amount of plant that contributes to cost, of plant remaining from additions in that year. This share will be larger the more recent the plant addition year and the larger were the plant additions made in that year. The average asset price rises over time as the price for each year of service life is replaced with the higher price for the following year. It will reflect inflation that occurred in numerous past years as well as current inflation. Note also that the depreciation rate varies with the age of the plant. For example, the depreciation rate in the last year of an asset's service life is 100%.

Implementation

The capital price and quantity indexes (relations [A5] and [A8]) were calculated for each sampled utility for two categories of assets: distribution plant and general plant. In these calculations, regional Handy-Whitman indexes of construction costs were used as the asset price indexes.[8] The value of N was set at 34 for distribution plant and 19 for general plant, numbers that were based on CVPS data. The values for gross plant additions VK_{t-s}^{add} in the years 1965-2006 were drawn from FERC Form 1. Values for earlier years were imputed using data on the net value of plant in 1964 and the construction cost index values for those years.

The calculation of the capital price index requires, in addition, an estimate of the rate of return trend.[9] The estimate is described in Table A-1 and Figure 2. It can be seen to be a weighted average of the returns on three kinds of returns: an ROE and the yields on Baa-rated corporate long bonds and on ten-year treasury notes. The weights for these three rates of return reflect the mix of funding sources employed recently by CVPS. The ROE was set equal to the ROE typically allowed under Vermont regulation.

A.2 Input Price Indexes

The growth rate of a summary input price index is defined by a formula that involves subindexes measuring growth in the prices of various kinds of inputs. Major

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[8] These data are reported in the *Handy-Whitman Index of Public Utility Construction Costs*, a publication of Whitman, Requardt and Associates.

[9] This calculation was made solely for the purpose of measuring input price and productivity *trends* and does not prescribe an appropriate Rate of Return *level* for the Company in this proceeding.

decisions in the design of such indexes include their form and the choice of input categories and price subindexes.

A.2.1 Index Form

The summary input price index used in this study is of Tornqvist form.[10] The growth rate of the index is a weighted average of the growth rates of input price subindexes. Each growth rate is calculated as the logarithm of the ratio of the subindex values in successive years. Data on the average shares of each input in the applicable total cost of distributors during the two years are the weights.

A.2.2 Input Price Subindexes and Costs

Applicable total cost was divided for purposes of input price trend calculations into four input categories: distribution plant, general plant, labor services, and other O&M inputs. The cost of labor was defined for this purpose as the sum of salaries and wages and a sensible share of pensions and other benefits. The cost of other O&M inputs was defined as O&M expenses net of these labor costs. The latter input category comprises a diverse set of inputs that includes materials, outsourced services, and leased equipment and real estate. The cost share for capital excluded taxes in the input price indexes used to calculate the inflation differential.

The price subindex for labor was constructed using the Employment Cost Index ("ECI") for the total labor cost of the electric, gas, and sanitary sector of the U.S. economy. An adjustment was made for the difference between regional and national labor cost trends. The price subindex for pensions and benefits was constructed from the national ECI for pensions and benefits in all industries. This was adjusted to be relevant to an electric utility in the Northeast. The price subindex for other O&M inputs was the GDPPI. The price subindexes for distribution and general plant were capital service price indexes. The capital price subindexes used in the inflation differential calculation did not include a term for taxes.

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[10] For seminal discussions of this index form see Tornqvist (1936).

A.2.3 Input Price Subindex Trends

Table A-2 presents additional information on the power distribution input price trends of sampled utilities. It can be seen that there were considerable differences in the price trajectories for the input categories. In particular, the price of labor rose much more rapidly on average than the GDPPI. This is normal and is the main reason why the economy's input price inflation is less than its output price inflation. The capital price index had the slowest growth due, chiefly, to the decline in bond yields during the sample period. The weighting on utility plant is sufficiently large that the summary input price index is quite sensitive to the capital price trend.

A.3 Input Quantity Indexes

The growth rate of a summary input quantity index is determined by a formula. As discussed in Section 2.1.4, the formula involves subindexes measuring growth in the amounts of various kinds of inputs used. Major decisions in the design of such indexes include their form and the choice of input categories and quantity subindexes.

A.3.1 Index Form

The input quantity index used in this study is of Tornqvist form. The growth rate of the index is a weighted average of the growth rates of the quantity subindexes. Each growth rate is calculated as the natural logarithm of the ratio of the quantities in successive years. Data on the average shares of each input in the applicable total distributor cost of sampled utilities during these two years are the weights.

A.3.2 Input Quantity Subindexes and Costs

Applicable total cost was divided into the same four input categories used to develop the input price index: distribution plant, general plant, labor services, and other O&M inputs. The quantity subindex for labor was the ratio of salary and wage expenses to a regionalized labor price index. The growth rate of this labor price index was calculated for most years as the growth rate of the national ECI for the salaries and wages of the electric, gas, and sanitary sector of the U.S. economy plus the difference between the growth rates of ECIs for workers in the relevant region and in the nation as a whole.

This general approach to measuring an input quantity trend, which is also used for the quantity of other O&M inputs, relies on the theoretical result that the growth rate in the cost of any class of input *j* is the sum of the growth rates in appropriate input price and quantity indexes for that input class. In that event,

$$growth\ Input\ Quantities_j = growth\ Cost_j - growth\ Input\ Prices_j. \quad [A9]$$

The quantity subindex for other O&M inputs was the ratio of the expenses for these inputs to the GDPPI. The trend in the subindex is then the difference between the trends in the expenses and the GDPPI. Recall from Part A.2.2 that the GDPPI was selected as a proxy for an index of the price trend of inputs in this particular input group.

A.3.3 Input Quantity Subindex Trends

Table A-3 presents additional information on the input quantity trends of CVPS and Northeast and US power distributors over the sample period. For the Northeast, it can be seen that the quantity of labor fell at a 1.21% average annual pace, whereas growth in the use of other O&M inputs averaged 1.63% annual growth. The quantity of distribution plant fell gradually, averaging a 0.15% annual decline. The quantity of general plant rose gradually. Patterns for CVPS were different chiefly in that the capital quantity fell more markedly and the labor quantity rose at about the pace of customer growth. This pattern reflects the aging of the Company's capital stock.

A.4 Relevant Region

Some criteria were noted in Section II.C that are useful for choosing a group of companies to use in input price and productivity indexing. A group of companies is needed that is large enough that the TFP trends of the group are not very sensitive to the trends of CVPS or other individual companies. A group characterized by similarity in the external pressures for unit cost growth that CVPS faces is also desirable.

With these goals in mind we calculated input price and productivity trends for a Northeast aggregate in addition to the trends in the full U.S. sample aggregate. Within the broader Northeast the companies were first identified for which the data needed for index calculations were available and of good quality.[11] A subgroup of companies was then sought in which the business environment for TFP growth was similar to that facing CVPS.

The resulting peer group consists of all "good data" companies with service territories lying in New England and upstate New York. By excluding New York City and the mid-Atlantic states most northeastern utilities are excluded that serve major metro areas.[12] The sampled companies, as a group, served less urbanized service territories and thus did not face marked pressure to increase undergrounding. The sample includes only one company (Connecticut Light and Power) that served over a million customers in 2005.

Note, finally, that many utilities in the Northeast operated under some kind of rate cap plan for several years of the sample period. The rate cap plans resulted from diverse circumstances that included retail competition, mergers, and PBR initiatives. The plans strengthened performance incentives and this likely served to accelerate TFP growth.

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[11] Several companies were excluded from the sample due to sizable transfers of assets between distribution and transmission.

[12] Boston is the obvious exception to the rule in the chosen sample.

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TABLES

Table 1

SAMPLED UTILITIES FOR INDEX RESEARCH

Alabama Power
AmerenUE
Appalachian Power
Arizona Public Service
Atlantic City Electric
Avista
Baltimore Gas & Electric
Bangor Hydro-Electric
Boston Edison
Carolina Power & Light
Central Hudson Gas & Electric
Central Illinois Light
Central Maine Power
Central Vermont Public Service
Cincinnati Gas & Electric
Cleco Power
Cleveland Electric Illuminating
Columbus Southern Power
Connecticut Light & Power
Duke Power
Edison Sault Electric
El Paso Electric
Empire District Electric
Entergy Arkansas
Entergy Louisiana
Entergy New Orleans
Florida Power & Light
Florida Power
Green Mountain Power
Hawaiian Electric
Idaho Power
Illinois Power
Kansas City Power & Light
KGE
Kentucky Power
Kentucky Utilities
Kingsport Power
Louisville Gas & Electric
Madison Gas & Electric
Maine Public Service
Mississippi Power
Mount Carmel Public Utility
Nevada Power
Niagara Mohawk
Northern Indiana Public Service
Northern States Power
Ohio Edison
Ohio Power
Oklahoma Gas & Electric
Orange & Rockland Utilities
Otter Tail Power
Pacific Gas and Electric
PacifiCorp.
Pennsylvania Power
Potomac Edison
Potomac Electric Power
PS of Indiana
Public Service Company of Colorado
Public Service Company of Oklahoma
Public Service Electric and Gas
Rochester Gas & Electric
San Diego Gas & Electric
Savannah Electric & Power
South Carolina Electric & Gas
Southern California Edison
Southern Indiana Gas & Electric
Southwestern Electric Power
Southwestern Public Service
Tampa Electric
Texas-New Mexico Power
Toledo Edison
Tucson Electric Power
Union Light, Heat & Power
United Illuminating
Virginia Electric & Power
West Penn Power
Western Massachusetts Electric
Wisconsin Electric Power
Wisconsin Power & Light
Wisconsin Public Service

***Bold indicates Northeast utility**

Table 2

HOW TRENDS IN CPI^U AND PRICE INDEXES FOR POWER DISTRIBUTOR BASE RATE INPUTS COMPARE

	CVPS		Northeast U.S.		U.S.		CPI^U	
Year	**Index**	**Growth Rate**[1]	**Index**	**Growth Rate**[1]	**Index**	**Growth Rate**[1]	**Index**	**Growth Rate**[1]
1996	1.000		1.000		1.000		156.9	
1997	1.027	2.6%	1.026	2.6%	1.026	2.6%	160.5	2.27%
1998	1.046	1.9%	1.045	1.8%	1.042	1.5%	163.0	1.55%
1999	1.080	3.2%	1.082	3.5%	1.080	3.6%	166.6	2.18%
2000	1.121	3.7%	1.126	4.0%	1.124	4.0%	172.2	3.31%
2001	1.151	2.6%	1.156	2.6%	1.147	2.0%	177.1	2.81%
2002	1.189	3.2%	1.192	3.1%	1.178	2.7%	179.9	1.57%
2003	1.215	2.2%	1.216	2.0%	1.195	1.5%	184.0	2.25%
2004	1.262	3.8%	1.262	3.7%	1.233	3.2%	188.9	2.63%
2005	1.298	2.8%	1.293	2.4%	1.252	1.5%	195.3	3.33%
2006	1.362	4.8%	1.359	5.0%	1.313	4.8%	201.6	3.17%
Average Annual Growth Rate								
1996-2006		**3.09%**		**3.07%**		**2.72%**		**2.51%**
1996-2003		**2.78%**		**2.79%**		**2.55%**		**2.28%**
2001-2006		**3.37%**		**3.24%**		**2.70%**		**2.59%**
2003-2006		**3.81%**		**3.71%**		**3.14%**		**3.04%**

[1] All growth rates computed logarithmically.

Table 3

How the Input Price Index for CVPS Subcap Costs Compares to $CPI^{Services}$

Year	Subcap Cost Shares			Input Price Escalation						Input Price Index		National $CPI^{Services}$	
	Labor	Pensions	Material	Labor		Pensions & Benefits		Materials		Index	Growth	Index	Growth
				Index	Growth	Index	Growth	Index	Growth				
1997	41.5%	16.7%	41.8%	37575	2.3%	101.57	1.6%	95.41	1.6%	1.019	1.9%	184.2	2.6%
1998	34.2%	15.5%	50.2%	38545	2.5%	104.04	2.4%	96.47	1.1%	1.038	1.9%	188.8	2.5%
1999	29.5%	17.1%	53.4%	39733	3.0%	106.63	2.5%	97.87	1.4%	1.060	2.1%	195.3	3.4%
2000	32.1%	14.6%	53.4%	40985	3.1%	112.59	5.4%	100.00	2.2%	1.092	3.0%	203.4	4.1%
2001	40.5%	19.0%	40.5%	42381	3.3%	118.01	4.7%	102.40	2.4%	1.127	3.1%	209.8	3.1%
2002	43.6%	20.9%	35.5%	44013	3.8%	125.10	5.8%	104.19	1.7%	1.166	3.4%	216.5	3.1%
2003	41.6%	23.1%	35.3%	45341	3.0%	133.49	6.5%	106.40	2.1%	1.207	3.4%	222.8	2.9%
2004	38.9%	25.4%	35.7%	46890	3.4%	145.09	8.3%	109.46	2.8%	1.261	4.4%	230.1	3.2%
2005	36.8%	26.6%	36.7%	48192	2.7%	155.26	6.8%	113.00	3.2%	1.311	3.9%	238.9	3.8%
2006	36.6%	29.6%	33.8%	49823	3.3%	163.26	5.0%	116.57	3.1%	1.361	3.7%	246.8	3.3%
Average Annual Growth Rate[1] **1996-2006**					**3.05%**		**4.90%**		**2.16%**		**3.08%**		**3.19%**

[1] All growth rates computed logarithmically.

Table 4

NON - POWER INPUT PRODUCTIVITY TRENDS

Year	Number of Customers Served			Input Quantity Index			Productivity Index		
	CVPS	**Northeast**	**U.S.**	**CVPS**	**Northeast**	**U.S.**	**CVPS**	**Northeast**	**U.S.**
1996	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1997	1.005	1.007	1.015	0.976	0.979	0.991	1.030	1.028	1.024
1998	1.011	1.013	1.029	1.065	0.987	1.001	0.950	1.026	1.028
1999	1.017	1.023	1.044	1.093	0.997	1.015	0.931	1.026	1.028
2000	1.028	1.030	1.058	1.006	1.004	1.013	1.022	1.026	1.045
2001	1.040	1.042	1.073	0.989	0.996	1.001	1.051	1.046	1.072
2002	1.053	1.048	1.085	0.994	1.018	1.001	1.059	1.030	1.084
2003	1.067	1.056	1.098	0.949	1.007	1.012	1.124	1.049	1.085
2004	1.077	1.062	1.111	0.963	0.996	1.011	1.119	1.066	1.099
2005	1.090	1.071	1.125	0.983	1.004	1.014	1.109	1.067	1.109
2006	1.104	1.079	1.132	1.008	1.002	1.021	1.095	1.077	1.108
Average Annual Growth Rate[1]									
1996-2006	**0.99%**	**0.76%**	**1.24%**	**0.08%**	**0.02%**	**0.21%**	**0.91%**	**0.74%**	**1.03%**
2001-2006	**1.21%**	**0.69%**	**1.06%**	**0.39%**	**0.11%**	**0.41%**	**0.82%**	**0.58%**	**0.66%**

[1] All growth rates computed logarithmically.

Figure 1

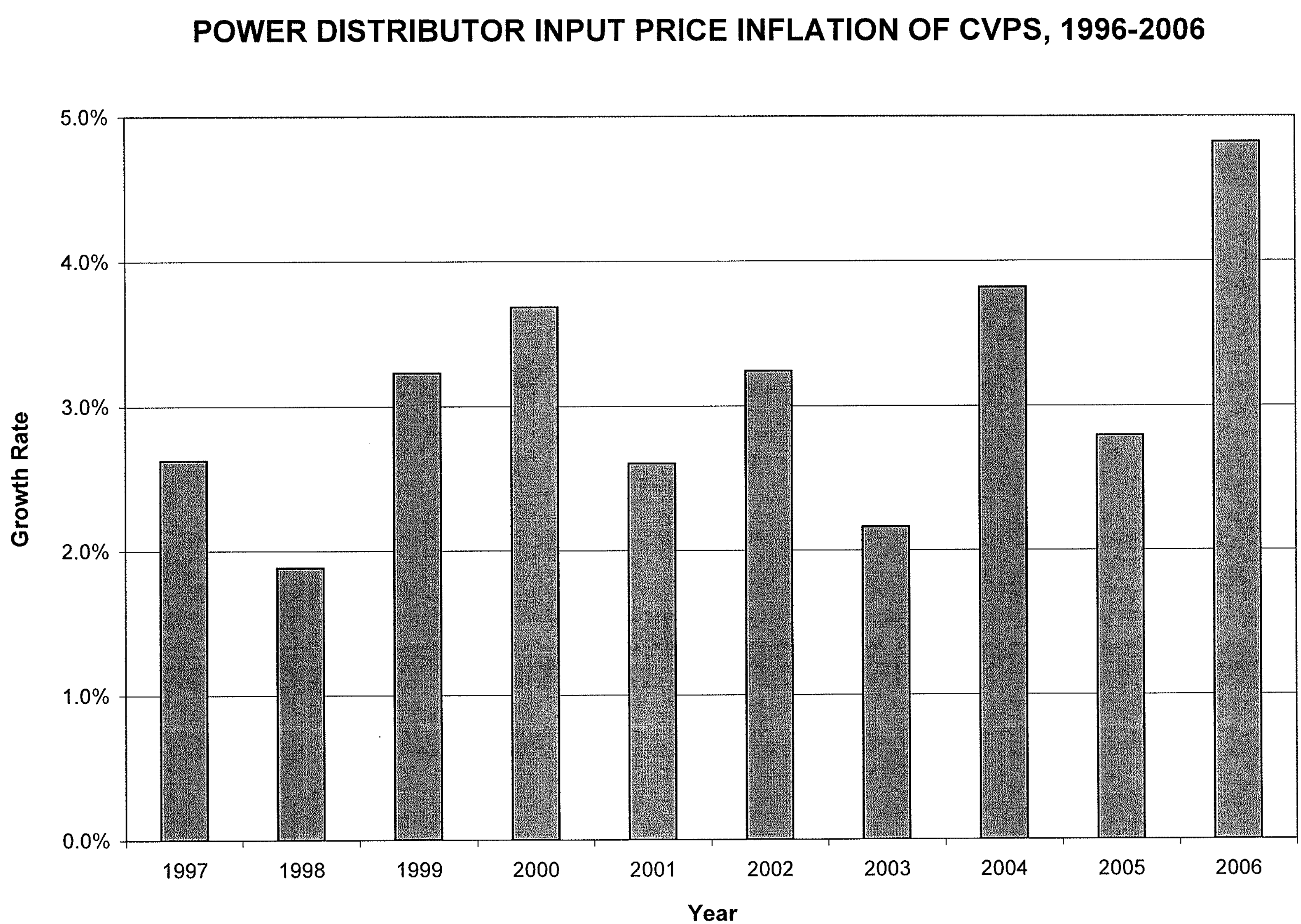
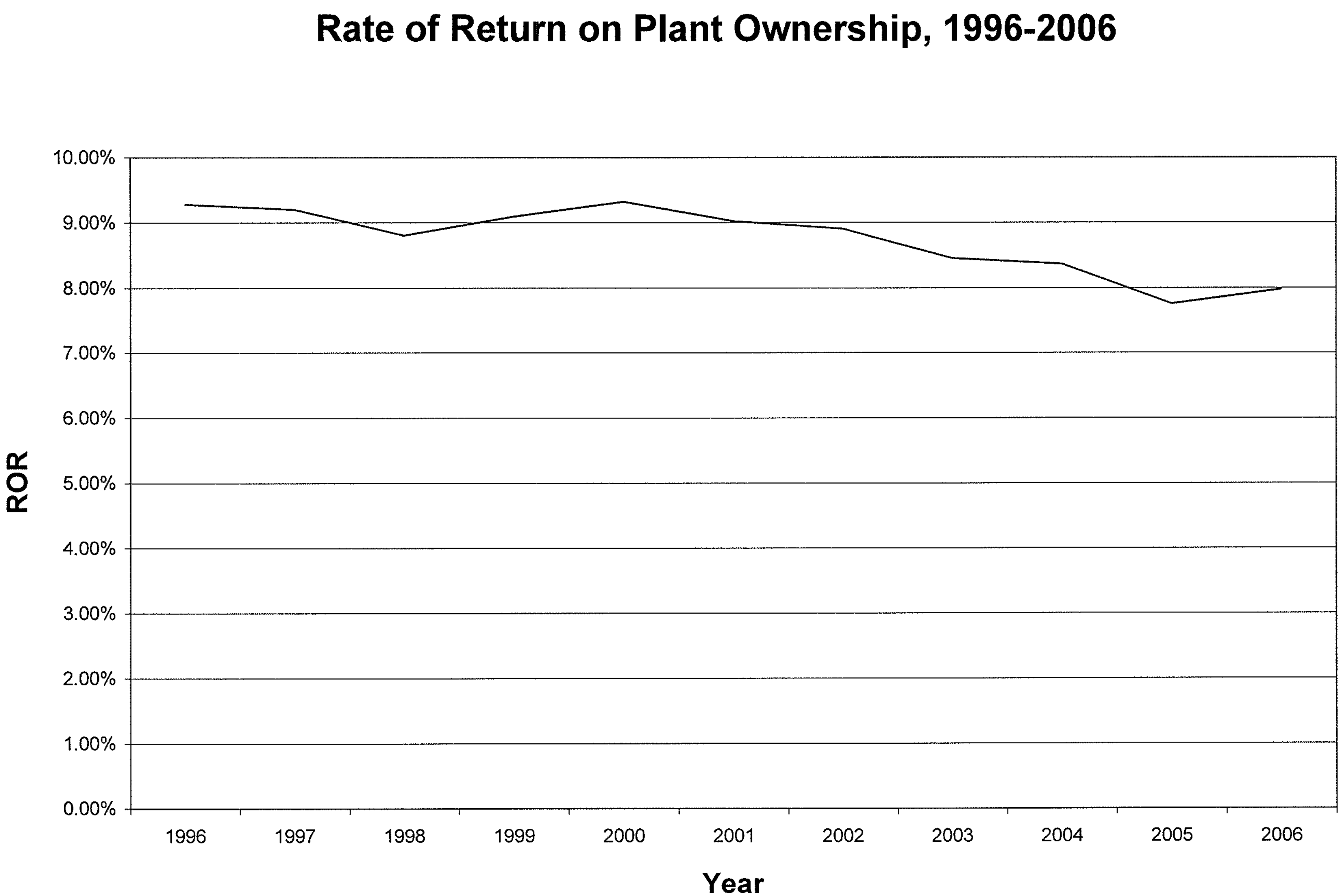

POWER DISTRIBUTOR INPUT PRICE INFLATION OF CVPS, 1996-2006
5.0%
4.0%
3.0%
2.0%
1.0%
0.0%
Growth Rate
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
Year

Figure 2



Rate of Return on Plant Ownership, 1996-2006
10.00%
9.00%
8.00%
7.00%
6.00%
5.00%
4.00%
3.00%
2.00%
1.00%
0.00%
ROR
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
Year

Table A.1

Trends in Investment Rates of Return

	Return on Equity		Bond Yields						Debt/Equity Weighted Average	
	Allowed Return on Equity, Vermont Utility[a]		Long Term Bonds				10-Year Treasury Bill[e]			
	[B]		Aaa[c]		Baa[d] [C]		[D]		[E]=[.345C+.500B+.155D][f]	
	Level	Growth Rate[b]	Level	Growth Rate[b]	Level	Growth Rate[b]	Level	Growth Rate[b]	Level	Growth Rate[b]
1994	10.0%	-18.23%	7.97%	9.88%	8.63%	8.46%	7.09%	18.88%	9.08%	-6.09%
1995	10.0%	0.00%	7.59%	-4.89%	8.20%	-5.11%	6.57%	-7.62%	8.85%	-2.55%
1996	11.0%	9.53%	7.37%	-2.94%	8.05%	-1.85%	6.44%	-2.00%	9.28%	4.73%
1997	11.0%	0.00%	7.27%	-1.37%	7.87%	-2.26%	6.35%	-1.41%	9.20%	-0.82%
1998	11.0%	0.00%	6.53%	-10.73%	7.22%	-8.62%	5.26%	-18.83%	8.81%	-4.37%
1999	11.0%	0.00%	7.05%	7.66%	7.88%	8.75%	5.65%	7.15%	9.10%	3.22%
2000	11.0%	0.00%	7.62%	7.77%	8.37%	6.03%	6.03%	6.51%	9.32%	2.47%
2001	11.0%	0.00%	7.08%	-7.35%	7.95%	-5.15%	5.02%	-18.33%	9.02%	-3.28%
2002	11.0%	0.00%	6.49%	-8.70%	7.80%	-1.90%	4.61%	-8.52%	8.91%	-1.29%
2003	11.0%	0.00%	5.66%	-13.68%	6.76%	-14.31%	4.01%	-13.94%	8.46%	-5.20%
2004	11.0%	0.00%	5.63%	-0.53%	6.39%	-5.63%	4.27%	6.28%	8.37%	-1.04%
2005	10.0%	-9.53%	5.23%	-7.37%	6.06%	-5.30%	4.29%	0.47%	7.76%	-7.58%
2006	10.0%	0.00%	5.59%	6.66%	6.48%	6.70%	4.80%	11.23%	7.98%	2.84%
2007	10.7%	6.86%	5.56%	-0.54%	6.48%	0.00%	4.63%	-3.61%		
Average Annual Growth Rate **1994-2006**	**10.79%**	**0.00%**	**6.74%**	**-2.96%**	**7.54%**	**-2.39%**	**5.45%**	**-3.25%**	**8.84%**	**-1.07%**

[a] Source: Regulatory Research Associates' survey of U.S. electricity utility major rate cases (2008).
[b] All growth rates computed logarthmically.
[c] Source: Federal Reserve. Seasoned AAA rating as evaluated by Moody's.
[d] Source: Federal Reserve. Seasoned Baa rating as evaluated by Moody's.
[e] Source: www.federalreserve.gov/releases/h15/data.htm.
[f] Source: Computed by PEG from MOU Exhibits and the 2006 CVPS FERC Form 1.

Table A.2

BASE RATE INPUT PRICE INDEX DETAILS

	Summary Input Price Index			Price Subindexes: Labor			Price Subindexes: Materials & Services	Price Subindexes: Distribution Capital			Price Subindexes: General Capital		
	CVPS	**Northeastern**	**U.S.**	**CVPS**	**Northeastern**	**U.S.**	**CVPS, NE, U.S.**	**CVPS**	**Northeastern**	**U.S.**	**CVPS**	**Northeastern**	**U.S.**
1996	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1997	1.027	1.026	1.026	1.026	1.026	1.030	1.016	1.035	1.033	1.031	1.036	1.038	1.033
1998	1.046	1.045	1.042	1.062	1.062	1.071	1.027	1.046	1.044	1.036	1.058	1.057	1.047
1999	1.080	1.082	1.080	1.093	1.093	1.100	1.042	1.104	1.106	1.094	1.122	1.113	1.101
2000	1.121	1.126	1.124	1.142	1.142	1.152	1.065	1.156	1.166	1.148	1.187	1.178	1.148
2001	1.151	1.156	1.147	1.187	1.187	1.198	1.091	1.171	1.184	1.159	1.234	1.215	1.173
2002	1.189	1.192	1.178	1.244	1.244	1.255	1.110	1.206	1.217	1.186	1.292	1.260	1.213
2003	1.215	1.216	1.195	1.297	1.297	1.310	1.133	1.202	1.217	1.182	1.336	1.259	1.224
2004	1.262	1.262	1.233	1.368	1.368	1.379	1.166	1.233	1.253	1.211	1.420	1.316	1.259
2005	1.298	1.293	1.252	1.447	1.447	1.454	1.203	1.214	1.236	1.193	1.485	1.353	1.271
2006	1.362	1.359	1.313	1.526	1.526	1.528	1.241	1.282	1.306	1.261	1.624	1.465	1.347
Average Annual Growth Rate[1]													
1996-2006	**3.09%**	**3.07%**	**2.72%**	**4.23%**	**4.23%**	**4.24%**	**2.16%**	**2.48%**	**2.67%**	**2.32%**	**4.85%**	**3.82%**	**2.98%**
2001-2006	**3.37%**	**3.24%**	**2.70%**	**5.03%**	**5.03%**	**4.86%**	**2.59%**	**1.80%**	**1.97%**	**1.69%**	**5.49%**	**3.74%**	**2.76%**
1996-2003	**2.78%**	**2.79%**	**2.55%**	**3.72%**	**3.72%**	**3.86%**	**1.79%**	**2.62%**	**2.81%**	**2.39%**	**4.14%**	**3.29%**	**2.88%**
2003-2006	**3.81%**	**3.71%**	**3.14%**	**5.42%**	**5.42%**	**5.13%**	**3.04%**	**2.16%**	**2.36%**	**2.17%**	**6.49%**	**5.05%**	**3.20%**

[1] All growth rates computed logarthmically.

Table A.3

BASE RATE INPUT QUANTITY INDEX DETAILS

	Input Quantity Subindexes											
	Labor			Materials & Services			Distribution Capital			General Capital		
	CVPS	**Northeast**	**U.S.**	**CVPS**	**Northeast**	**U.S.**	**CVPS**	**Northeast**	**U.S.**	**CVPS**	**Northeast**	**U.S.**
1996	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1997	1.000	0.971	0.939	0.937	0.982	1.007	0.997	0.985	1.005	0.892	0.965	0.970
1998	1.048	1.024	0.919	1.241	1.006	1.060	0.991	0.973	1.004	0.891	0.974	0.984
1999	0.983	1.030	0.901	1.457	1.062	1.119	0.961	0.962	1.010	0.940	1.027	0.984
2000	0.946	0.993	0.872	1.233	1.126	1.122	0.920	0.955	1.017	0.875	1.102	0.960
2001	1.033	0.964	0.838	1.094	1.122	1.105	0.908	0.957	1.021	0.845	1.158	0.961
2002	1.047	0.992	0.812	1.079	1.180	1.110	0.918	0.960	1.027	0.854	1.248	0.914
2003	1.024	0.945	0.815	0.969	1.189	1.143	0.902	0.965	1.039	0.768	1.184	0.899
2004	1.035	0.891	0.787	1.034	1.161	1.134	0.902	0.983	1.051	0.703	1.166	0.870
2005	1.069	0.886	0.791	1.101	1.194	1.144	0.895	0.984	1.060	0.654	1.144	0.828
2006	1.122	0.886	0.789	1.163	1.176	1.162	0.893	0.985	1.072	0.568	1.021	0.766
Average Annual Growth Rate[1]												
1996-2006	**1.15%**	**-1.21%**	**-2.38%**	**1.51%**	**1.63%**	**1.50%**	**-1.13%**	**-0.15%**	**0.70%**	**-5.66%**	**0.21%**	**-2.66%**
2001-2006	**1.65%**	**-1.69%**	**-1.22%**	**1.22%**	**0.94%**	**1.01%**	**-0.33%**	**0.57%**	**0.99%**	**-7.96%**	**-2.51%**	**-4.53%**

[1] All growth rates computed logarthmically.